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Vehicular Ad Hoc Networks (VANETS)and Protocols a Review

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ABSTRACT: Now days the facet of vehicular ad hoc network (VANET) is becoming remarkable research area; VANETis considered as a special case of mobile ad hoc network (MANET). VANET described as self-governing and self-configured wireless network. However, VANET have vibrant topology, large size, and constrained mobility; these characteristics lead to the need for efficient routing and resource savingVANET protocolsget rid with different VANET environments. Due to these differences traditional MANET's protocolsunsuitable for VANET. This paper gives anoverview of Vehicular ad hoc networks (VANETs)comparisons between VANET and MANET,Characteristics, various routing protocols and applications.

Keywords: VANET's, MANET, challenges, Routing Protocols**, application**

I. INTRODUCTION

Lots of people dieevery year due to car accidents andalso manyof them get injured. Implementations ofsafety rules such as speed limits and roadstatus are used in many countriesbut still more work to be required.Taking into account theconstant growth of automotive industry and theincreasing demand for the car safety, also driven bygovernmentauthority, the potential ofcar-to-car connectivity is immense such systemshould be suitable for a wide range ofapplications, including safety-related and traffic.

Recently, it has been accepted by the academics and industry that the cooperation between vehicles and road transportation systems can considerably improve driver's safety road efficiency and reduce environmental impact. Vehicular networks have received intensive of research work in the recent years due to the wide variety of services they provide.

In VANETs are a subset of MANETs and communication nodes are mainly vehicles. A mobile adhoc network is a collection of two or morenodes equipped with wireless communications andnetworking capabilities without central network control,which may be referred to as an infrastructure-less mobilenetwork [3]. VANETs are distributed, selfmanaging communication networks built up by movingvehicles and thus characterized by very high nodemobility and limited degrees of freedom in the mobilitypatterns.

One of the challenges posed by this problem is the confinement of the routing problem to vehicle-to-vehicle (V2V) scenarios as opposed to also utilizing the wireless infrastructure[2]. VANETs applications are classified into safety and efficiency [1]. In VANET systems many difficulties are in design and implementation, security, privacy, routing, connectivity, and QoS.

II. WHAT IS VANET

A vehicular ad hoc network (VANET) uses cars as mobile nodes, every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and in turn create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created.

A. VANET Architecture

VANET is an autonomous and self-organizing wirelesscommunication network that operates without any permanentinfrastructure and access point for communication andpropagation of information. In VANET nodes themselvesacts as servers and/or clients for exchanging & sharinginformation [1].As shown in figures the network architecture of VANET can be classified intofollowing three categories:

Inter-vehicle communication/ pure Ad Hoc: This is also known as vehicle-to-vehicle (V2V) communication or pure ad hocnetworking. In this category, the vehicles communicate among each other with no infrastructure support. Any valuableinformation collected from sensors on a vehicle can be sent to neighboring vehicles,as shown in fig 1.

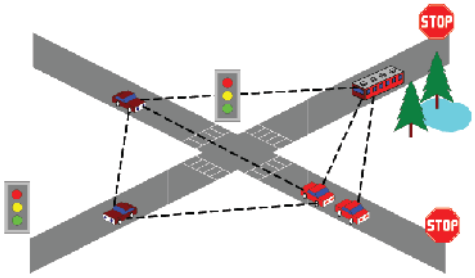

Fig. 1. ADHOC.

Vehicle-to-road side communication/ pure cellular or WLAN: This is also known as vehicle-to-infrastructure (V2I) communication. In thiscategory, the vehicles can use cellular gate ways and wireless local area network access points to connect to the Internetand facilitate vehicular applications.

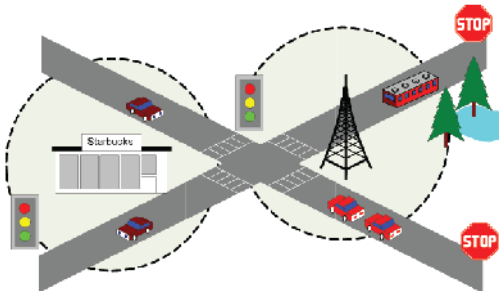

Fig. 2. WLAN/CELLULAR.

Inter-road side communication/hybrid: This is also known as hybrid vehicles-to-roadside communication. Vehicles can useinfrastructure to communicate with each other and share the information received from infrastructure with othervehicles in a peer-to-peer mode through ad hoc communication. This architecture includes V2V communication andprovides greater flexibility in content sharing. Vehicular AdHoc Networks (VANET) should, uponimplementation, collect and distribute safetyinformation to massively reduce the number ofaccidents by warning drivers about the dangerbefore they actually face it. Such networkscomprise of sensors and On Board Units (OBU) installed in the car as well as Road Side Units (RSU). The data collected from the sensors onthe vehicles can be displayed to the driver, sentto the RSU or even broadcasted to other vehiclesdepending on its nature and importance.

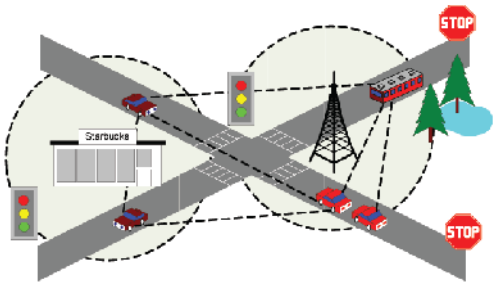

Fig. 3. Hybrid.

TheRSU distributes this data, along with data fromroad sensors, weather centers, traffic controlcenters, etc to the vehicles and also providescommercial services such as parking spacebooking, Internet access and gas payment. Thenetwork makes extensive use of wirelesscommunications to achieve its goals but althoughwireless communications reached a level ofmaturity, a lot more is required to implementsuch a complex system. Most available wirelesssystems rely on a basestation for synchronizationand other services; however using this approachmeans covering all roads with such infrastructurewhich is impractically too expensive. Ad hocnetworks have been studied for some time butVANET will form the biggest ad hoc networkever implemented, therefore issues of stabilityreliability and scalability are of concern. VANETtherefore is not an architectural network and notan ad hoc network but a combination of both; thisunique characteristic combined with high speednodes complicates the design of the network.

B. Characteristics of VANET

Similar to mobile ad hoc networks (MANETs), nodes in VANETs self-organize and self-manage information in a distributed fashion without a centralized authority or a server dictating the communication [5]. In this type of network, nodesengage themselves as servers and/or clients,thereby exchanging and sharing information likepeers. Moreover, nodes are mobile, thus makingdata transmission less reliable and suboptimal.Apart from these characteristics, VANETs possessa few unique characteristics, presentingitself a particular challenging class of MANETs:

Exceptionally progressive topology: In vehicular correspondence systems (VCNs), hubs are moving and changing their position continually. Thus the system topology changes as often as possible as the connections between hubs unites and detaches and the term of time that remaining parts for trade of information parcels is little. Every pair of hubs can impart straightforwardly when they have an observable pathway to one another inside of the radio reach.

Every now and again disengaged system (Intermittent availability): The profoundly dynamic topology results in as often as possible detached system since the connection between two vehicles can rapidly vanish while the two hubs are transmitting data. The issue is further exacerbated by heterogeneous hub thickness where often voyaged streets have a bigger number of autos than non-as often as possible voyaged streets. In addition, (non) surge hours just result in unique hub thickness, in this way disconnectivity. A powerful directing convention needs to perceive the successive disconnectivity and gives an option connect rapidly to guarantee continuous correspondence.

Designed Mobility: Vehicles take after a trail or certain versatility design which is a fundamental's element streets, activity lights, velocity points of confinement, movement condition and driving practices of drivers. As a result of the specific portability design, assessment of VANET directing conventions just bodes well from follows got from the example. There is a few VANET versatility follow generators produced for the testing of VANET directing conventions in reenactment. A reasonable versatility follows were produced from vehicles to test the conventions.

Propagation Model: The propagation model in VANETs isusually not assumed to be free space because of the presenceof buildings, trees, vehicles and other obstacles. A VANETpropagation model should well consider the effects of staticobjects as well as potential interference of wirelesscommunication from other vehicles or widely deployedpersonal access points.Unlimited Battery Power and Storage: The nodes inVANETs are not subject to power and storage limitation as insensor networks, another class of ad hoc networks wherenodes are mostly static. Nodes are assumed to have ampleenergy and computing power and hence the optimizing dutycycle is not as relevant as it is in sensor networks.

On-board Sensors: In VANETs the nodes are assumed to beequipped with sensors to provide information for routingpurposes. Many VANET routing protocols have assumed theavailability of GPS unit from on-board Navigation system.Location information from GPS unit and speed fromspeedometer provides good examples for large amount ofinformation that can possibly be obtained by sensors to beutilized to enhance routing decisions.

III. CHALLENGES IN VANET

VANET supports diverse range of on road applications and hence requires efficient and effective radio resource management strategies. This includes QOS control, capacity enhancement, interference control, call admission control (CAC), bandwidth reservation, packet loss reduction, packet scheduling and fairness assurance. The existing approaches designed for MANETs are ineffective and/or inefficient and cannot be directly applied in VANET. To accomplish various applications in a vehicular environment, new and effective strategies are required to be tailored specifically meant for VANET.

Following are the key research challenges in VANET: -

Frequent Link Disconnections: As discussed in the previous section that unlike nodes in MANETs, vehicles are highly mobile and generally travel at higher speeds, especially on highways (i.e., over 100 km/hr) and thus changes the topology of a network which causes intermittent communication links between a source and a destination. Moreover, the network resources allocated to vehicles go in vain due to frequent link disconnections.

Node Distribution: In the real world, vehicles are not uniformly distributed in the given region. Hot spots like commercial district and shopping centers can attract more people, which results in higher node densities in these areas. The heterogeneous distributions of vehicles raise a great challenge for design of routing algorithms.

Inter-contact time and duration time: Inter-contact time characterizes the distribution of the interval between two inter-vehicle contacts. The network connectivity is better if the inter-contact time is smaller. The duration time of a contact decides the amount of data can be transmitted within a contact, which is typically small, in the scale of seconds.

IV. ROUTING PROTOCOLS

A routing protocol governs the way that two communication entities exchange information; it includes the procedure in establishing a route, decision in forwarding, and action in maintaining the route or recovering from routing failure. [5] VANETs are a particular class of specially appointed systems; the regularly utilized impromptu steering conventions at first actualized for MANETs have been tried and assessed for use in a VANET situation. Utilization of these location based and topology based directing conventions requires that each of the taking an interest hubs be alloted a novel location. This suggests that we require an instrument that can be utilized to dole out remarkable locations to vehicles however these conventions don't promise the evasion of portion of copy locations in the system. Subsequently, existing conveyed tending to calculations utilized as a part of versatile specially appointed systems are considerably less suitable in a VANET situation.

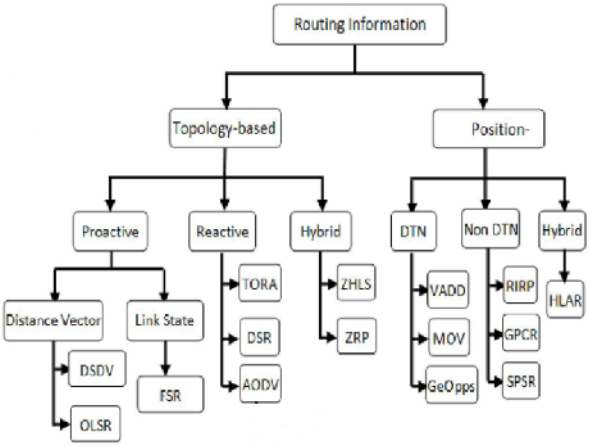

Fig. 4. Tree diagram of VANET protocols.

Specific VANET related issues such asnetwork topology, mobility patterns, density of vehicles at different times of the day, rapid changes in vehicles arrivingand leaving the VANET and the fact that the width of the road is often smaller than the transmission range all make theuse of these conventional ad hoc routing protocols inadequate.The routing protocol of VANET can be classified into two categories such as Topology based routing protocols &Position based routing protocols.Topology based routing is further classified into Proactive and Reactive Protocols [6] [7].

V. APPLICATIONS

A large number of applications have beenspecified by governments for DSRC applications [8],we cover here a few of them. Traffic control is amajor factor for efficient use of thenetwork.Currently traffic lights organize the flow oftraffic at junctions. With DSRC traffic lightsbecome adaptive to the traffic and can providepriority to emergency vehicles as well as safetyto pedestrians and cyclists. Moreover informationabout the status of the road can be distributed tocars to warn them of problems ahead such as iceor maintenance work on the road. This systemwill also be very efficient in the case of accidents,automatically notifying the nearest ambulanceand other emergency vehicles to approach theaccident if needed and even provide telemedicineservices if the patient requires immediateattention, especially when there are no nearbyhospitals. Crash prevention is the main motivebehind ITS, therefore a number of applicationshave been specified. Crash preventionapplications that rely on an infrastructure includeroad geometry warning to help drivers at steep orcurved roads and warn overweight or overheightvehicles, highway-rail crossing and intersectioncollision systems to help drivers cross safely, pedestrian, cyclist and animal warning systems toinform drivers of possible collisions, thesesystems become of vital importance at night orunder low visibility conditions.

Safety applications which do not rely on aninfrastructure include an emergency brakeannouncement which is the most importantapplication for crash prevention. The first twocars might not benefit from the emergency brakesystem but further cars can avoid the crash. Lanechange assistance, road obstacle detection, roaddeparture warning as well as forward and rearcollision warning are all examples of safety V2Vapplications. Vehicles can also automaticallysend help requests in case of accidents which canbe vital when no other cars are around. Anongoing European project, eCall, aims atproviding this automatic call service by 2009using existing cellular infrastructure. TheOBU system can also help the driver in otherdifferent ways such as vision enhancement viaimage processing techniques, lane keepingassistance and monitoring of onboard systems aswell as any cargo or trailers connected to thevehicle. Such systems are generalized asAdvanced Driver Assistance Systems (ADAS). The commercial applications of the systemcover a wide range of innovative ideas aidingindividuals and tourists such as booking aparking place, downloading tourism informationand maps for restaurants and gas stations,navigation and route guidance, payment at tollplazas, Internet access and connection to homecomputers.

Other devices within the vehicle canalso be connected to the On Board Units (OBU)to access any services provided by the network orthrough the Internet.

Highway Lane Reservation an innovative VANET applicationcan be incorporated into thehighway system [4]. The idea is to allow drivers toreserve an "entry slot" onto dedicated lanes of ahighway by paying a premium price. Reservationswill be allowed for these lanes up to their carryingcapacity, so that the dedicated lanes will neverbecome jammed and the system can guaranteethe trip duration between any two highway points,in the absence of accidents.

VI. CONCLUSION

In this article we have clarified that what is vehicular ad hoc networks, architecture & characteristics of VANET. Different protocols used auto configuration, technical challenges and potential applications make it anessential part of future pervasive computingenvironments.The vehicular ad hoc networkwill become widely used in near future. The researchin this field will continue being very active and imaginative. Therefore we may conclude that futures network is VANET.We hopethat this paper will be an instrument for the students and researchers to address the challenges involved in VANET.

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